

REMARKS

Claims 1, 2 and 4-32 are pending herein. Claims 1, 4-6, 10, 12-14, 16-18, 20, 25, 27 and 29 have been amended to correct matters of form. Claims 1 and 4 have been further amended as supported by Fig. 1 of the present application. Claim 3 has been cancelled without prejudice or disclaimer in favor of new claim 31. New claim 32 has been added and corresponds to original claim 2 and depends from claim 31. Attached hereto as pages 15-21, pursuant to Rule 1.121(c)(1)(ii), is a marked-up version of the amended claims.

Although the PTO did not object to the drawings, a Submission of Proposed Drawing Amendment is filed herewith to show that the figuring plate member recited in claim 28 should be depicted as numeral 210 in Fig. 25. The approval of the Examiner is respectfully requested.

1. Claims 1, 2, 4 and 6-30 were rejected under §102(e) over Takeuchi et al. (U.S. Patent No. 6,249,370). This rejection is respectfully traversed.

The present invention is directed to a display device and method for producing the same. With reference to Fig. 1 of the present application, claim 1 recites that the display device includes an actuator substrate 12 and an actuator element (i.e., electrodes 28 and 30 having shape-retaining layer 26 positioned therebetween). A cross piece 56, which surrounds the actuator element, intervenes between an optical waveguide plate 14 and the actuator substrate. A picture element assembly 58 is joined onto the actuator element. The picture element assembly is disposed closely to or contacts the optical waveguide plate when the actuator element is in a state of no load, i.e., when the actuator element is not being energized by a driving source (specification, page 10, lines 20-22). Claim 1 has been amended to recite that the picture element assembly, which, as explained above, in a state of no load, causes light to be emitted from the optical waveguide plate when disposed closely to or in contact with the waveguide plate.

Claim 4 recites substantially the same subject matter of claim 1 except that the picture element assembly is in pressed contact with the optical waveguide plate when the actuator element is in a state of no load. Similar to claim 1 discussed above, claim 4 has been amended to recite that light is emitted from the optical waveguide plate when the picture

element assembly, in a state of no load, is in pressed contact with the waveguide plate.

Method claims 6 and 22 each recite, among other things, the step of hardening the picture assembly element in a state in which the actuator element is displaced to provide a picture element assembly precursor that abuts against the optical waveguide plate.

Method claims 12 and 16 each recite, among other things, that the picture element assembly makes pressed contact with the optical waveguide plate in accordance with shrinkage caused by the hardening of the cross piece precursor.

Method claim 27 recites, among other things, a step of forming a first precursor of a first part of a picture element assembly on an actuator element, and then hardening the first precursor to form the first part of the picture element assembly. A crosspiece precursor is then formed to surround the actuator element, and hardened to form a crosspiece. A second precursor of a second part of the picture element assembly is formed on the first part of the picture element assembly, and then hardened to form the second part of the picture element assembly.

Takeuchi '370 discloses a display device. With reference to Fig. 1 of Takeuchi '370, a displacement transmitting section 18 includes a plate member 18a having a light-emitting element 50 provided on an upper surface. A displacement-transmitting member 18b is positioned below the plate member and is used to transmit the displacement action of actuator element 14 to the plate member. A light-shielding section 52 is provided around the outer circumferential portion of plate member 18a. When the actuator elements are driven, light-shielding section 52 contacts the back surface of light-shielding plate 12, and light-emitting element 50 is inserted into the corresponding light-transmitting section 20 (column 14, lines 16-27 of Takeuchi '370). Consequently, the light-shielding section 52 constitutes a shutter mechanism which is driven by a shutter means (i.e., actuator element 14 and displacement-transmitting section 18) for selectively shielding the light-transmitting section 20 (column 14, lines 34-40 of Takeuchi '370).

The PTO is apparently contending that the combination of Figs. 1 and 38 of Takeuchi '370 disclose the features of the present invention. However, Fig. 38 of Takeuchi '370 illustrates a display device that operates under light emission principles (i.e., light reflection)

that are different from the display device shown in Fig. 1 of Takeuchi '370 (i.e., shutter means). For example, the display device shown in Fig. 38 operates to reflect light guided into the optical waveguide plate only when the displacement transmitting section 420 abuts a surface of the optical waveguide plate. In contrast to the device shown in Fig. 38, the device shown in Fig. 1 of Takeuchi '370 discloses that holes (i.e., light transmitting sections) are formed in the light shielding plate, which is not a light *waveguide* plate. The holes are opened and closed by shutter means for controlling the light passing through the light transmitting sections. Therefore, one skilled in the art would have had no motivation to combine the devices shown in Figs. 1 and 38 of Takeuchi '370 to arrive at the present invention since those devices clearly operate under different principles of light emission.

Moreover, for the reasons explained above, the combination of the light reflection mechanism shown in Fig. 1 of Takeuchi '370 with the shutter means shown in Fig. 38 of Takeuchi '370, as asserted in the Office Action, would result in a structure that is technically inoperable. Again, the display devices shown in Figs. 1 and 38 of Takeuchi '370 clearly operate under different principles of light emission, and thus, are not properly combinable as asserted by the PTO.

Even if the devices shown in Figs. 1 and 38 of Takeuchi '370 were attempted to be combined as asserted in the Office Action, the resultant structure would not include picture elements that are disposed closely to or in contact or in pressed contact against the waveguide plate when the actuator elements are in the no-load state.¹ Fig. 38 and its corresponding description clearly show that the displacement-transmitting section 420 is pressed against the waveguide plate only in an applied load state (not in a no-load state, as claimed). As such, the asserted combination of Figs. 1 and 38 of Takeuchi '370 fails to disclose each and every element of independent claims 1, 4, 6, 12, 16 and 22. For this reason alone, the §102(e) rejection over Takeuchi '370 is erroneous and should be withdrawn.

Furthermore, the displacement-transmitting section 420 shown in the left side in Fig.

¹Column 1, line 62 -- column 2, line 2 of Takeuchi '370 discloses that "[i]n the illustrative display device shown in Fig. 38, the displacement-transmitting section 420 is arranged such that it is located closely near to the optical waveguide plate 418 in the OFF selection state or the unselected state in which the actuator element 400 stands still while it contacts with the optical waveguide plate 418 in the ON selection state..."

38 of Takeuchi '370 does not correspond to the claimed picture element assembly. This is so because light is not capable of being emitted from displacement-transmitting section 420 when the actuator elements are in the no load state, as now recited in each of claims 1 and 4. It is clear that light does not scatter at the portion of displacement-transmitting section 420 which seems to be in contact with the waveguide plate 418. Rather, light is emitted from the waveguide plate only when actuator element 400 contacts the waveguide plate in the ON selection state (see col. 1, line 62 -- col. 2, line 2 of Takeuchi '370). Therefore, Takeuchi '370 does not disclose or suggest the picture element assembly recited in amended claims 1 and 4.

With respect to claim 2, the PTO asserts (erroneously) that Takeuchi '370 discloses that a "distance between the picture element assembly 18 and the optical waveguide plate 418 in the state of no load is not more than 30% of a distance of separation between the picture element assembly 18 and the optical waveguide 418 in a driving state" (see page 3 of the Office Action). This assertion is clearly erroneous because the PTO's cited passage (column 13, lines 19-21) relates only to the porosity of an anti-ferroelectric film, and does not provide even a remote disclosure of a separation distance between the picture element assembly 18 and optical waveguide plate 418.

Nor does Takeuchi '370 disclose or suggest the subject matter of new claim 31. As explained above, original claim 3 has been cancelled without prejudice or disclaimer in favor of new claim 31. Applicants respectfully submit that there is no disclosure in Takeuchi '370, or Takeuchi '275 for that matter, of a picture element assembly being brought into contact with a waveguide plate when voltage is applied having a polarity opposite to a voltage applied to the actuator element to separate the picture element assembly from the waveguide plate, as recited in claim 31.²

With respect to method claims 6-11 and 22-26, one skilled in the art would not

² The PTO's citation to col. 37, line 7-13 of Takeuchi '275 establishes only that a displacement transmitting section 32 (shown in Fig. 1 of Takeuchi '275) can be pressed against a waveguide plate by means of the displacement force of the main actuator element. Applicants respectfully submit that this disclosure adds nothing to the disclosure in Takeuchi '370.

understand the disclosure in Takeuchi '370 as disclosing a step of hardening the picture assembly element while the actuator element is being displaced to provide a picture element assembly precursor that abuts against the optical waveguide plate, as is recited in each of independent claims 6 and 22. In fact, as discussed above, Fig. 1 of Takeuchi clearly shows that light emitting element 50 and light-shielding section 52 are spaced from the optical waveguide plate when the actuator elements are in a state of no load.

With respect to method claims 12-21, Applicants respectfully request that the PTO specifically point to disclosure in Takeuchi '370 of the picture element assembly making pressed contact with the optical waveguide plate in accordance with shrinkage caused by the hardening of the cross piece precursor, as recited in each of independent claims 12 and 16.

With respect to method claims 27-30, Applicants respectfully request that the PTO specifically point to disclosure in Takeuchi '370 of forming and hardening a first picture element assembly precursor to form a first part of a picture element assembly, and subsequently forming and hardening a second picture element assembly precursor on the first part of the picture element assembly, as recited in independent claim 27.

In view of the foregoing, reconsideration and withdrawal of the rejection of claims 1, 2, 4 and 6-30 under §102(e) over Takeuchi '370 are respectfully requested.


2. Claims 3 and 5 were rejected under §103(a) over Takeuchi '370 in view of Takeuchi et al. (U.S. Patent No. 5,862,275). The above cancellation of claim 3 renders this rejection moot with respect to claim 3. Applicants respectfully submit that the arguments submitted above distinguish claim 4 from Takeuchi '370. Since Takeuchi '275 does not overcome the deficiencies of Takeuchi '370, and since claim 5 depends directly from claim 4, claim 5 is also believed to be allowable over the applied art.

The PTO is requested to confirm receipt and consideration of the Information Disclosure Statements filed on June 13, 2001, March 26, 2002, June 27, 2002 and September 16, 2002.

If the Examiner believes that contact with Applicants' attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicants' attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,



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1. (Amended) A display device comprising an actuator substrate having an actuator element, an optical waveguide plate, a crosspiece ~~intervening~~allowed to intervene between said optical waveguide plate and said actuator substrate ~~and~~for surrounding said actuator element, and a picture element assembly joined onto said actuator element, wherein:

said picture element assembly, in a state of no load, is disposed closely to, or it ~~makes contacts with~~ said optical waveguide plate so as to cause light to be emitted from the optical waveguide plate in a state of no load.

4. (Amended) A display device comprising an actuator substrate having an actuator element, an optical waveguide plate, a crosspiece ~~intervening~~allowed to intervene between said optical waveguide plate and said actuator substrate ~~and~~for surrounds said actuator element, and a picture element assembly joined onto said actuator element, wherein:

said picture element assembly, in a state of no load, is ~~in~~allowed to make pressed contact with said optical waveguide plate so as to cause light to be emitted from the optical waveguide plate in a state of no load.

5. (Amended) The display device according to claim 4, wherein said picture element assembly is ~~in~~allowed to make said pressed contact with said optical waveguide plate by being urged toward said optical waveguide plate ~~by~~due to the elasticity of a thin-walled section of said actuator substrate when said actuator element is in said state of no load.

6. (Amended) A method for producing a display device, comprising:

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a step of forming a crosspiece precursor for surrounding an actuator element on any one of an optical waveguide plate and an actuator substrate having said actuator element;

a step of forming a picture element assembly precursor on any one of said actuator element and said optical waveguide plate;

a step of joining said actuator substrate and said optical waveguide plate to one another by the aid of said picture element assembly precursor and any one of said crosspiece precursor ~~or~~ and a crosspiece formed by hardening said crosspiece precursor;

a step of hardening said picture element assembly precursor on said actuator element to form a picture element assembly; and

a step of hardening said crosspiece precursor to form said crosspiece, wherein:

when said step of hardening said picture element assembly precursor is carried out, hardening is performed in a state in which said actuator element is displaced, and said picture element assembly precursor abuts against said optical waveguide plate.

10. (Amended) The method for producing said display device according to claim 6, further comprising:

performing a step of applying an adhesive to any one of said crosspiece precursor, said crosspiece, said actuator substrate, said optical waveguide plate, and a light-shielding layer formed on said optical waveguide plate, wherein:

said actuator substrate and said optical waveguide plate are joined to one another by the aid of any one of said crosspiece precursor ~~or~~ and said crosspiece, and any one of said picture element assembly precursor ~~or~~ and said picture element assembly by hardening said adhesive.

12. (Amended) A method for producing a display device, comprising:

- a step of forming a picture element assembly precursor on an actuator element ~~of~~supported by an actuator substrate having said actuator element;
- a step of forming a crosspiece precursor for surrounding said actuator element on any one of said actuator substrate and an optical waveguide plate;
- a step of joining said substrate and said optical waveguide plate to one another by the aid of said crosspiece precursor and any one of said picture element assembly precursor ~~or and said a~~ picture element assembly formed by hardening said picture element assembly precursor;
- a step of hardening said picture element assembly precursor to form said picture element assembly; and
- a step of hardening said crosspiece precursor to form a crosspiece, wherein:
 - said picture element assembly is in~~allowed to make~~ pressed contact with said optical waveguide plate in accordance with shrinkage caused by hardening of said crosspiece precursor.

13. (Amended) The method for producing said display device according to claim 12, wherein when said step of hardening said picture element assembly precursor is carried out, hardening is performed in a state in which said actuator element is displaced, and said picture element assembly precursor ~~makes abutment~~abuts against said optical waveguide plate.

14. (Amended) The method for producing said display device according to claim 12, wherein when said step of hardening said crosspiece precursor is carried

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out, hardening is performed in a state in which said actuator element is displaced, and said picture element assembly ~~makes abutment~~ abuts against said optical waveguide plate.

16. (Amended) A method for producing a display device, comprising:
- a step of forming a crosspiece precursor for surrounding an actuator element on any one of an optical waveguide plate and an actuator substrate having said actuator element;
 - a step of forming a picture element assembly precursor on said optical waveguide plate;
 - a step of joining said actuator substrate and said optical waveguide plate to one another by the aid of said crosspiece precursor and said picture element assembly precursor, and arranging said picture element assembly on said actuator element;
 - a step of hardening said picture element assembly precursor on said actuator element to form a picture element assembly; and
 - a step of hardening said crosspiece precursor to form a crosspiece, wherein:
 - said picture element assembly is ~~in~~ allowed to make pressed contact with said optical waveguide plate in accordance with shrinkage caused by hardening of said crosspiece precursor.

17. (Amended) The method for producing said display device according to claim 16, wherein when said step of hardening said picture element assembly precursor is carried out, hardening is performed in a state in which said actuator element is displaced, and said picture element assembly precursor ~~makes~~

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~~abutment~~abuts against said optical waveguide plate.

18. (Amended) The method for producing said display device according to claim 16, wherein when said step of hardening said crosspiece precursor is carried out, hardening is performed in a state in which said actuator element is displaced, and said picture element assembly ~~makes abutment~~abuts against said optical waveguide plate.

20. (Amended) The method for producing said display device according to claim 16, further comprising:

performing a step of applying an adhesive to any one of said crosspiece precursor, said crosspiece, said actuator substrate, said optical waveguide plate, and a light-shielding layer formed on said optical waveguide plate, wherein:

said actuator substrate and said optical waveguide plate are joined to one another by the aid of any one of said crosspiece precursor ~~or~~and said crosspiece, and any one of said picture element assembly precursor ~~or~~and said picture element assembly by hardening said adhesive.

25. (Amended) The method for producing said display device according to claim 22, further comprising:

performing a step of applying an adhesive to any one of said crosspiece precursor, said crosspiece, said actuator substrate, said optical waveguide plate, and a light-shielding layer formed on said optical waveguide plate, wherein:

said actuator substrate and said optical waveguide plate are joined to one

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another by the aid of any one of said crosspiece precursor ~~or~~and said crosspiece, and any one of said picture element assembly precursor ~~or~~and said picture element assembly by hardening said adhesive.

27. (Amended) A method for producing a display device, comprising:
- a step of forming a first precursor of a first part of a picture element assembly on an actuator element ~~of~~supported by an actuator substrate ~~having said actuator element, followed by~~said first precursor being hardened to form said first part of said picture element assembly;
 - a step of forming a crosspiece precursor for surrounding said actuator element on said actuator substrate;
 - a step of defining an upper surface of said crosspiece precursor, and then hardening said crosspiece precursor to form a crosspiece;
 - a step of forming a second precursor of ~~another~~a second part of said picture element assembly on said first part of said picture element assembly on said actuator substrate;
 - a step of joining an optical waveguide plate and said actuator substrate to one another by the aid of said crosspiece and said picture element assembly precursor; and
 - a step of hardening said second precursor of said ~~another~~second part of said picture element assembly on said actuator element to form said picture element assembly.

29. (Amended) The method for producing said display device according to claim 27, further comprising:
- performing a step of applying an adhesive to any one of said crosspiece precursor, said crosspiece, said actuator substrate, said optical waveguide plate, and a

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light-shielding layer formed on said optical waveguide plate, wherein:

said actuator substrate and said optical waveguide plate are joined to one another by the aid of any one of said crosspiece precursor ~~or~~and said crosspiece, and any one of said picture element assembly precursor ~~or~~and said picture element assembly by hardening said adhesive.

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The heading beginning at page 1, line 3 has been amended as follows:

~~BACKGROUND OF THE INVENTION~~

The heading beginning at page 1, line 10 has been amended as follows:

~~Description~~Background of the Invention~~Related Art~~:

The paragraph beginning at page 3, line 9 has been amended as follows:

The picture element assembly 20, which is formed on the actuator element 18, is a laminate comprising a ~~white~~light scattering element layer 32, a color filter layer 34, and a transparent layer 36. As described later on, when the picture element assembly 20 abuts against the optical waveguide plate 14, the light 38, which is guided through the inside of the optical waveguide plate 14, is reflected. In this process, the light 38 is colored to have a color corresponding to a color of the color filter layer 34, and the light 38 is emitted to the outside of the optical waveguide plate 14. Accordingly, the unit dot 22 emits light with the color corresponding to the color filter layer 34.

The paragraph beginning at page 4, line 19 has been amended as follows:

In the display device 10 constructed as described above, as shown in FIG. 39, when the upper end surface of the picture element assembly 20 (transparent layer 36) abuts against the optical waveguide plate 14, then the light 38, which is guided through the inside of the optical waveguide plate 14, is transmitted through the transparent layer 36 and the color filter layer 34, and then it is reflected by the ~~white~~light scattering element layer 32. The light is emitted as ~~the~~ scattered light 42 to

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the outside of the optical waveguide plate 14. As a result, the display device 10 causes light emission with the color corresponding to the color filter layer 34.

The paragraph beginning at page 5, line 4 has been amended as follows:

When the voltage is applied between the column electrode 28 and the row electrode 30, for example, if the column electrode 28 is the positive electrode, then the electric field, which is directed from the column electrode 28 to the row electrode 30, is generated. As a result, the polarization is induced in the shape-retaining layer 26, and the strain, which is directed to the column electrode 28, is generated in the shape-retaining layer 26. As shown in FIG. 41, the strain causes bending deformation of the actuator element 18. The entire actuator element 18 is displaced downwardly, and the upper end surface of the picture element assembly 20 is separated from the optical waveguide plate 14. In this situation, the light 38 is not reflected by the picture element assembly 20, and it is guided through the inside of the optical waveguide plate 14. Therefore, the light 38 is not emitted to the outside of the optical waveguide plate 14. That is, in this situation, the display device 10 is in the light off state.

The paragraph beginning at page 8, line 9 has been amended as follows:

Subsequently, a precursor of the ~~white~~light scattering element layer 32, a precursor of the color filter layer 34, and a precursor of the transparent layer 36 are formed in this order on the actuator element 18. Accordingly, a precursor of the picture element assembly 20 is obtained. The respective precursors can be also formed by means of the film formation method as described above.

The paragraph beginning at page 9, line 5 has been amended as follows:

The precursor of the crosspiece 16 and the precursor of the picture element assembly 20 undergo slight shrinkage during the heat treatment respectively. Of course, the heights of the respective precursors and the heat treatment condition are set so that the crosspiece 16 and the picture element assembly 20 have desired sizes in consideration of the amounts of shrinkage.

The paragraph beginning at page 9, line 12 has been amended as follows:

However, even when the deposition heights of the respective precursors and the heat treatment condition are set as described above, the size of the picture element assembly 20 is insufficient in some cases. If such a situation occurs, ~~the~~ a gap appears between the optical waveguide plate 14 and the upper end surface of the picture element assembly 20, even when it is intended to allow the display device 10 to be in the light emission state. As a result, the luminance of the unit dot 20 is lowered. That is, it is impossible to obtain a desired luminance.

The heading beginning at page 24, line 16 has been amended as follows:

DETAILED DESCRIPTION OF THE INVENTION~~PREFERRED EMBODIMENTS~~

The paragraph beginning at page 24, line 24 has been amended as follows:

FIG. 1 shows a schematic sectional view illustrating a unit dot 52 provided for a display device 50 according to an embodiment of the present invention. The display device 50 comprises an actuator substrate 12 which has an actuator element 18 (shown in Fig. 7), an optical waveguide plate 14, and a hardened or cured resin which

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contains a filler 54. The display device 50 further comprises crosspieces 56 which are allowed to intervene between the actuator substrate 12 and the optical waveguide plate 14, and a picture element assembly 58 which is joined onto the actuator element 18.

The paragraph beginning at page 27, line 13 has been amended as follows:

The construction of the picture element assembly 58 conforms to the construction of the picture element assembly 20 of the unit dot 22 described above, except that the picture element assembly 58 presses the optical waveguide plate 14 in the state of no load, and that the adhesion-suppressing agent 66 is formed on the upper end surface of the picture element assembly 58. That is, the picture element assembly 58 is a laminate of the ~~white~~light scattering element layer 32, the color filter layer 34, the transparent layer 36, and the adhesion-suppressing agent 66. The adhesion-suppressing agent 66 is formed on the upper end surface of the transparent layer 36 (see FIG. 1).

The paragraph beginning at page 27, line 25 has been amended as follows:

In the same manner as in the unit dot 22 described above, when the voltage is applied between the column electrode 28 and the row electrode 30, if the column electrode 28 is, for example, the positive electrode, then the actuator element 18 is continuously displaced toward the actuator substrate 12 in accordance with the level of the voltage. When the applied voltage is changed so that the difference in electric potential between ~~the~~ both electrodes 28, 30 is decreased, the actuator element 18 is

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continuously displaced toward the optical waveguide plate 14.

The paragraph beginning at page 28, line 15 has been amended as follows:

When the state of no load is established, the picture element assembly 58 is urged toward the optical waveguide plate 14 in accordance with the elasticity of the thin-walled section 12a. Accordingly, the picture element assembly 58 makes pressed contact with the optical waveguide plate 14. Therefore, the light 38, which is guided through the inside of the optical waveguide plate 14, is reliably reflected by the picture element assembly 58. The light 38 behaves as ~~the~~scattered light 42 which is emitted to the outside of the optical waveguide plate 14. Therefore, it is possible to allow the unit dot 52 (display device 50) to emit light at a desired luminance.

The paragraph beginning at page 41, line 23 has been amended as follows:

Subsequently, in the step SA13 (see FIG. 5), as shown in FIG. 8, the precursor 32a of the ~~white~~light scattering element layer 32, the precursor 34a of the color filter layer 34, and the precursor 36a of the transparent layer 36 are formed on the actuator element 18 in this order. Thus, the picture element assembly precursor 58a is formed. Alternatively, although not shown, the light-reflective layer composed of metal may be formed before forming the precursor 32a of the ~~white~~light scattering element layer 32. In this case, it is desirable that the insulating layer is further formed before forming the light-reflective layer.

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The paragraph beginning at page 42, line 7 has been amended as follows:

The precursor 32a of the whitelight scattering element layer 32 of the picture element assembly precursor 58a can be formed by using thermosetting resin such as epoxy resin in which titanium oxide or the like is previously dispersed. The precursor 34a of the color filter layer 34 can be formed by using thermosetting resin such as epoxy resin in which fluorescent pigment is previously dispersed. Further, the precursor 36a of the transparent layer 36 can be formed by using thermosetting resin such as epoxy resin.

The paragraph beginning at page 42, line 16 has been amended as follows:

The precursor 32a of the whitelight scattering element layer 32 and the precursor 34a of the color filter layer 34 may be hardened at this point of time. The both precursors 32a, 34a may be formed and hardened before forming the crosspiece precursor 56a.

The paragraph beginning at page 52, line 7 has been amended as follows:

Finally, in the step SC12 (see FIG. 5), the picture element assembly precursor 58a on the actuator element 18 is hardened to form the picture element assembly 58. That is, all of the precursor 32a of the whitelight scattering element layer 32, the precursor 34a of the color filter layer 34, and the precursor 36a of the transparent layer 36 are hardened to form the whitelight scattering element layer 32, the color filter layer 34, and the transparent layer 36. Accordingly, the display device 50, which is provided with a plurality of unit dots 52, is consequently obtained.

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The paragraph beginning at page 72, line 4 has been amended as follows:

Subsequently, in the step SA61 (see FIG. 22), the respective precursors 32a, 34a of the white scattering element layer 32 and the color filter layer 34, which are included in the respective precursors 32a, 34a, 36a of the whitelight scattering element layer 32, the color filter layer 34, and the transparent layer 36 for constructing the picture element assembly 58, are formed on the actuator element 18 of the substrate 12. After that, in the step SA62 (see FIG. 22), as shown in FIG. 23, the respective precursors 32a, 34a of the whitelight scattering element layer 32 and the color filter layer 34 are hardened by means of the heat treatment to form the whitelight scattering element layer 32 and the color filter layer 34.

The paragraph beginning at page 79, line 19 has been amended as follows:

Accordingly, during the aging period (step S3) thereafter, the high viscosity grease consequently float at an upper portion of the precursor 36a of the transparent layer 36. As shown in FIGS. 30A and 30B, wrinkle-shaped irregularities 212 are easily formed on the upper end surface of the precursor 36a. Owing to the foregoing countermeasures, it is possible to avoid any whitelight defect or the like on the image display.

Please replace the heading beginning at page 1, line 10 with the following rewritten heading:

Background of the Invention:

Please replace the paragraph beginning at page 3, line 9 with the following rewritten paragraph:

31 The picture element assembly 20, which is formed on the actuator element 18, is a laminate comprising a light scattering element layer 32, a color filter layer 34, and a transparent layer 36. As described later on, when the picture element assembly 20 abuts against the optical waveguide plate 14, the light 38, which is guided through the inside of the optical waveguide plate 14, is reflected. In this process, the light 38 is colored to have a color corresponding to a color of the color filter layer 34, and the light 38 is emitted to the outside of the optical waveguide plate 14. Accordingly, the unit dot 22 emits light with the color corresponding to the color filter layer 34.

Please replace the paragraph beginning at page 4, line 19 with the following rewritten paragraph:

32 In the display device 10 constructed as described above, as shown in FIG. 39, when the upper end surface of the picture element assembly 20 (transparent layer 36) abuts against the optical waveguide plate 14, then the light 38, which is guided through the inside of the optical waveguide plate 14, is transmitted through the transparent layer 36 and the color filter layer 34, and then it is reflected by the light scattering element layer 32. The light is emitted as scattered light 42 to the outside of

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cont

the optical waveguide plate 14. As a result, the display device 10 causes light emission with the color corresponding to the color filter layer 34.

Please replace the paragraph beginning at page 5, line 4 with the following rewritten paragraph:

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When the voltage is applied between the column electrode 28 and the row electrode 30, for example, if the column electrode 28 is the positive electrode, then the electric field, which is directed from the column electrode 28 to the row electrode 30, is generated. As a result, the polarization is induced in the shape-retaining layer 26, and the strain, which is directed to the column electrode 28, is generated in the shape-retaining layer 26. As shown in FIG. 41, the strain causes bending deformation of the actuator element 18. The entire actuator element 18 is displaced downwardly, and the upper end surface of the picture element assembly 20 is separated from the optical waveguide plate 14. In this situation, the light 38 is not reflected by the picture element assembly 20, and it is guided through the inside of the optical waveguide plate 14. Therefore, the light 38 is not emitted to the outside of the optical waveguide plate 14. That is, in this situation, the display device 10 is in the light off state.

Please replace the paragraph beginning at page 8, line 9 with the following rewritten paragraph:

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Subsequently, a precursor of the light scattering element layer 32, a precursor of the color filter layer 34, and a precursor of the transparent layer 36 are formed in

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this order on the actuator element 18. Accordingly, a precursor of the picture element assembly 20 is obtained. The respective precursors can be also formed by means of the film formation method as described above.

Please replace the paragraph beginning at page 9, line 5 with the following rewritten paragraph:

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The precursor of the crosspiece 16 and the precursor of the picture element assembly 20 undergo slight shrinkage during the heat treatment respectively. Of course, the heights of the respective precursors and the heat treatment condition are set so that the crosspiece 16 and the picture element assembly 20 have desired sizes in consideration of the amounts of shrinkage.

Please replace the paragraph beginning at page 9, line 12 with the following rewritten paragraph:

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However, even when the deposition heights of the respective precursors and the heat treatment condition are set as described above, the size of the picture element assembly 20 is insufficient in some cases. If such a situation occurs, a gap appears between the optical waveguide plate 14 and the upper end surface of the picture element assembly 20, even when it is intended to allow the display device 10 to be in the light emission state. As a result, the luminance of the unit dot 20 is lowered. That is, it is impossible to obtain a desired luminance.

Substitute specification paragraphs

Please replace the heading beginning at page 24, line 16 with the following rewritten heading:

37 DETAILED DESCRIPTION OF THE INVENTION

Please replace the paragraph beginning at page 24, line 24 with the following rewritten paragraph:

B8 FIG. 1 shows a schematic sectional view illustrating a unit dot 52 provided for a display device 50 according to an embodiment of the present invention. The display device 50 comprises an actuator substrate 12 which has an actuator element 18 (shown in Fig. 7), an optical waveguide plate 14, and a hardened or cured resin which contains a filler 54. The display device 50 further comprises crosspieces 56 which are allowed to intervene between the actuator substrate 12 and the optical waveguide plate 14, and a picture element assembly 58 which is joined onto the actuator element 18.

Please replace the paragraph beginning at page 27, line 13 with the following rewritten paragraph:

B9 The construction of the picture element assembly 58 conforms to the construction of the picture element assembly 20 of the unit dot 22 described above, except that the picture element assembly 58 presses the optical waveguide plate 14 in the state of no load, and that the adhesion-suppressing agent 66 is formed on the upper end surface of the picture element assembly 58. That is, the picture element assembly 58 is a laminate of the light scattering element layer 32, the color filter layer 34, the

Substitute specification paragraphs

39
can

transparent layer 36, and the adhesion-suppressing agent 66. The adhesion-suppressing agent 66 is formed on the upper end surface of the transparent layer 36 (see FIG. 1).

Please replace the paragraph beginning at page 27, line 25 with the following rewritten paragraph:

B10

In the same manner as in the unit dot 22 described above, when the voltage is applied between the column electrode 28 and the row electrode 30, if the column electrode 28 is, for example, the positive electrode, then the actuator element 18 is continuously displaced toward the actuator substrate 12 in accordance with the level of the voltage. When the applied voltage is changed so that the difference in electric potential between both electrodes 28, 30 is decreased, the actuator element 18 is continuously displaced toward the optical waveguide plate 14.

Please replace the paragraph beginning at page 28, line 15 with the following rewritten paragraph:

B11

When the state of no load is established, the picture element assembly 58 is urged toward the optical waveguide plate 14 in accordance with the elasticity of the thin-walled section 12a. Accordingly, the picture element assembly 58 makes pressed contact with the optical waveguide plate 14. Therefore, the light 38, which is guided through the inside of the optical waveguide plate 14, is reliably reflected by the picture element assembly 58. The light 38 behaves as scattered light 42 which is emitted to the outside of the optical waveguide plate 14. Therefore, it is possible to

Substitute specification paragraphs

B11
cont

allow the unit dot 52 (display device 50) to emit light at a desired luminance.

Please replace the paragraph beginning at page 41, line 23 with the following rewritten paragraph:

B12

Subsequently, in the step SA13 (see FIG. 5), as shown in FIG. 8, the precursor 32a of the light scattering element layer 32, the precursor 34a of the color filter layer 34, and the precursor 36a of the transparent layer 36 are formed on the actuator element 18 in this order. Thus, the picture element assembly precursor 58a is formed. Alternatively, although not shown, the light-reflective layer composed of metal may be formed before forming the precursor 32a of the light scattering element layer 32. In this case, it is desirable that the insulating layer is further formed before forming the light-reflective layer.

Please replace the paragraph beginning at page 42, line 7 with the following rewritten paragraph:

B13

The precursor 32a of the light scattering element layer 32 of the picture element assembly precursor 58a can be formed by using thermosetting resin such as epoxy resin in which titanium oxide or the like is previously dispersed. The precursor 34a of the color filter layer 34 can be formed by using thermosetting resin such as epoxy resin in which fluorescent pigment is previously dispersed. Further, the precursor 36a of the transparent layer 36 can be formed by using thermosetting resin such as epoxy resin.

Substitute specification paragraphs

Please replace the paragraph beginning at page 42, line 16 with the following rewritten paragraph:

B14
The precursor 32a of the light scattering element layer 32 and the precursor 34a of the color filter layer 34 may be hardened at this point of time. The both precursors 32a, 34a may be formed and hardened before forming the crosspiece precursor 56a.

Please replace the paragraph beginning at page 52, line 7 with the following rewritten paragraph:

B15
Finally, in the step SC12 (see FIG. 5), the picture element assembly precursor 58a on the actuator element 18 is hardened to form the picture element assembly 58. That is, all of the precursor 32a of the light scattering element layer 32, the precursor 34a of the color filter layer 34, and the precursor 36a of the transparent layer 36 are hardened to form the light scattering element layer 32, the color filter layer 34, and the transparent layer 36. Accordingly, the display device 50, which is provided with a plurality of unit dots 52, is consequently obtained.

Please replace the paragraph beginning at page 72, line 4 with the following rewritten paragraph:

B16
Subsequently, in the step SA61 (see FIG. 22), the respective precursors 32a, 34a of the white scattering element layer 32 and the color filter layer 34, which are included in the respective precursors 32a, 34a, 36a of the light scattering element layer 32, the color filter layer 34, and the transparent layer 36 for constructing the

Substitute specification paragraphs

B14
cont

picture element assembly 58, are formed on the actuator element 18 of the substrate 12. After that, in the step SA62 (see FIG. 22), as shown in FIG. 23, the respective precursors 32a, 34a of the light scattering element layer 32 and the color filter layer 34 are hardened by means of the heat treatment to form the light scattering element layer 32 and the color filter layer 34.

Please replace the paragraph beginning at page 79, line 19 with the following rewritten paragraph:

B17

Accordingly, during the aging period (step S3) thereafter, the high viscosity grease consequently float at an upper portion of the precursor 36a of the transparent layer 36. As shown in FIGS. 30A and 30B, wrinkle-shaped irregularities 212 are easily formed on the upper end surface of the precursor 36a. Owing to the foregoing countermeasures, it is possible to avoid any light defect or the like on the image display.

Substitute specification paragraphs